WHAT IS CLAIMED IS:

1. A method for reconstructing an image of an object in a three-dimensional coordinate system with an x-ray computed tomography system, the method comprising the steps of:

conducting a partial scan of the object by rotating an x-ray beam having a cone beam geometry around a portion of the object or rotating the object in the x-ray beam, the x-ray beam forming a scanning trajectory through a plurality of projection lines from a plurality of successive focal point locations;

detecting the x-ray beam, attenuated by the object during the scan, to produce detector values;

integrating the detector values along the projection lines to obtain intermediate data; and

calculating three-dimensional Radon values representing substantially accurate or approximate plane integrals of the object from the intermediate data using a Grangeat relationship.

2. The method of claim 1, wherein the step of conducting a partial scan includes rotating the x-ray beam around the object continuously or piece-wise continuously.

3. The method of claim 1, wherein the scanning trajectory is substantially circular.

4. The method of claim 1, wherein the scanning trajectory is substantially helical, spiral, or spiral-like.

5. The method of claim 1, wherein the step of integrating is performed explicitly.

6. The method fo claim 1, wherein eh step of integrating is performed implicitly.

7. The method of claim 1, wherein the step of calculating three-dimensional radon values uses a modified or extended version of the Grangeat relationship.

8. The method of claim 7, wherein in the modified or extended version of the Grangeat relationship, a mosaic of truncated fan-beams are used to cover a plane and estimate the radon value as the plane integral.

9. The method of claim 7, wherein in the modified or extended version of the Grangeat algorithm, each characteristic point in the radon space is categorized into singly, doubly, triply sampled, and shadow regions.

10. The method of claim 9, wherein each characteristic point is weighted appropriately to suppress image artifacts.

11. The method of claim 1, further comprising using at least one smooth weighting function to suppress data inconsistencies and associated image artifacts.

12. The method of claim 9, wherein the shadow regions are estimated by interpolation or extrapolation to remove artifacts due to missing information.

13. The method of claim 1, wherein the object is a short object.

14. The method of claim 1, wherein the object is a long object.

15. The method of claim 1, wherein the partial scan is less than 360 degrees.

16. A device for reconstructing an image of an object in a three-dimensional coordinate system with an x-ray computed tomography system, the device comprising:

a scanner for conducting a partial scan of the object by rotating an x-ray beam having a cone beam geometry around a portion of the object or rotating the object in the x-ray beam, the x-ray beam forming a scanning trajectory through a plurality of projection lines from a plurality of successive focal point locations;

detectors for detecting the x-ray beam, attenuated by the object during the scan, to produce detector values; and

a processor for integrating the detector values along the projection lines to obtain intermediate data and calculating three-dimensional Radon values representing approximate or substantially accurate plane integrals of the object from the intermediate data using a Grangeat relationship.

17. The device of claim 16, wherein the scanner rotates the x-ray beam around the object continuously or piece-wise continuously.

18. The device of claim 16, wherein the scanning trajectory is substantially circular.

19. The device of claim 16, wherein the scanning trajectory is substantially helical, spiral, or spiral-like.

20. The device of claim 16, wherein the processor performs integration explicitly.

21. The device of claim 16, wherein the processor performs integration implicitly.

22. The device of claim 16, wherein the processor calculates three-dimensional Radon values using a modified or extended version of the Grangeat relationship.

23. The device of claim 22, wherein in the modified or extended version of the Grangeat relationship, a mosaic of truncated fan-beams are used to cover a plane and estimate the radon value as the plane integral.

24. The device of claim 22, wherein in the modified or extended version of the Grangeat algorithm, each characteristic point in the radon space is categorized into singly, doubly, triply sampled, and shadow regions.

25. The device of claim 24, wherein each characteristic point is weighted appropriately to suppress image artifacts.

26. The device of claim 16, wherein the processor uses at least one smooth weighting function to suppress data inconsistencies and associated image artifacts.

27. The device of claim 24, wherein the shadow regions are estimated by interpolation or extrapolation to remove artifacts due to missing information.

28. The device of claim 16, wherein the object is a short object.

29. The device of claim 16, wherein the object is a long object.

30. The device of claim 16, wherein the scan is less than 360 degrees.